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KELLOGG, HUBER, HANSEN, TODD & EVANS, P.L.L.C.

SUMNER SQUARE
1615 M STREET, N.W.
SUITE 400
WASHINGTON, D.C. 20036-3209

(202) 326-7900
FACSIMILE:
(202) 326-7999

April 26, 2001

VIA HAND DELIVERY

EX PARTE

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: **Ex Parte Communication in ET Docket No. 98-206; RM-9147; RM-9245; Applications of Broadwave USA et al., PDC Broadband Corporation, and Satellite Receivers, Ltd., to provide a fixed service in the 12.2-12.7 GHz Band; Requests of Broadwave USA et al. (DA 99-494), PDC Broadband Corporation (DA 00-1841), and Satellite Receivers, Ltd. (DA 00-2134) for Waiver of Part 101 Rules.**

Dear Ms. Salas:

On April 25, 2001, Sophia Collier and Antoinette Cook Bush of Northpoint Technology, Ltd. ("Northpoint") met with the following Commission officials: Thomas Stanley, Michael Pollak, and Nese Guendelsberger of the Wireless Telecommunications Bureau. The purpose of this meeting was to discuss Northpoint's comments and reply comments in the above-referenced proceedings, as well as the attached handout.

Eighteen copies of this letter are enclosed – two for inclusion in each of the above-referenced files. Please contact me if you have any questions.

Yours sincerely,

J C Rozendaal /CB

J.C. Rozendaal

cc: Thomas Stanley
Michael Pollak
Nese Guendelsberger

Northpoint Technology

Annotated Version of
MITRE Technical Report – Abstract and Executive Summary

Analysis of Potential MVDDS Interference to DBS in the 12.2-12.7 GHz Band

April 25, 2001

MTR 01W0000024

MITRE TECHNICAL REPORT

Analysis of Potential MVDDS Interference to DBS in the 12.2–12.7 GHz Band

April 2001

MITRE

Text Boxes indicate Northpoint comments.
Emphasis added by Northpoint.

Abstract

Bottomline:

MITRE recommends licensing of new service.

The frequency band between 12.2 and 12.7 gigahertz (GHz) is allocated to Fixed and Broadcasting-Satellite radio services on a co-primary basis. In the United States, this band is widely used for direct broadcast satellite (DBS) services. Terrestrial radiocommunication services are also permitted, provided that these do not interfere with the satellite services. In 1999, Broadwave USA, a subsidiary of Northpoint Technologies, filed a petition with the Federal Communications Commission (FCC) seeking an authorization to operate terrestrial stations delivering Multichannel Video Distribution and Data Service (MVDDS) in the 12.2–12.7 GHz band. Since that time, numerous concerns have been raised about the extent and impact of potential interference of MVDDS transmissions on the existing DBS service. This report provides a thorough assessment of MVDDS interference into DBS receivers. It is based on a comprehensive analysis that included extensive laboratory and field measurements. The analysis also made use of modeling and simulation techniques to validate published and measured performance results. Special attention was given to the degradation of system availability in the presence of rain losses. The report also discusses possible interference-mitigation approaches, recommends a process for licensing MVDDS transmitters, and addresses key policy issues.

KEYWORDS: Spectrum sharing, MVDDS, DBS, interference, broadcast satellite, EchoStar, DIRECTV, Dish TV, Northpoint, video quality.

Text Boxes indicate Northpoint comments.
Emphasis added by Northpoint.

Executive Summary

The frequency band between 12.2 and 12.7 gigahertz (GHz) is allocated to the Fixed and Broadcasting-Satellite radio services on a co-primary basis. International Telecommunications Union (ITU) Footnote S5.490 permits the operation of stations that provide "terrestrial radiocommunication services" in the same band, subject to the restriction that they "shall not cause harmful interference to the space services operating in conformity with the broadcasting satellite Plan for Region 2 contained in Appendix S30." CFR 47, Part 100 codifies U.S. regulations for Direct Broadcast Satellite (DBS) service in this band.

In 1999, Broadwave USA, a subsidiary of Northpoint Technologies, Inc., filed a petition with the Federal Communications Commission (FCC) seeking an authorization to operate terrestrial stations delivering Multichannel Video Distribution and Data Service (MVDDS) in the 12.2–12.7 GHz band. Subsequently, two other companies, PDC Broadband Corporation and Satellite Receivers, Ltd. filed similar applications with the FCC.

The FCC issued a Notice of Proposed Rulemaking on 24 November 1998, and a First Report and Order (R&O) and a Further Notice of Proposed Rulemaking (NPRM) as ET Docket 98-206 on 8 December 2000. These documents address the issues associated with permitting MVDDS in the band, and conclude that sharing the band between MVDDS and DBS systems is possible, subject to certain precautions that must be taken to prevent interference to DBS systems.

MITRE Report had two goals:

1. **Analyzing general issues of sharing between MVDDS and DBS**
2. **Demonstration of specific technologies of Northpoint, Pegasus and Satellite Receivers using equipment provided by the specific company.**

The FCC's Fiscal Year (FY) 2001 budget authorization contains a requirement that the FCC select an independent engineering firm to perform an analysis to determine whether these two services can share the band without harmful interference to DBS systems. The FCC selected The MITRE Corporation to perform this work. The 19 January 2001 Statement of Work for the project says that "The objective of the tasks is to perform a technical demonstration or analysis of any terrestrial service technology proposed by any entity that has filed an application to provide terrestrial service in the direct broadcast satellite frequency band to determine whether the terrestrial service technology proposed to be provided by that entity will cause harmful interference to any direct broadcast satellite service."

MITRE's effort was divided into tasks in the following areas:

- Equipment measurements
- Satellite receiver simulation
- Propagation and rain-attenuation modeling
- Interference predictions

All measurements for the project were conducted at MITRE's laboratories in Bedford, Massachusetts. MITRE measured the radiation patterns of three DBS antennas and two MVDDS antennas in its anechoic chamber, which has been extensively used to make measurements of critical defense systems for several years. DBS receiver susceptibility to MVDDS interference was measured in the laboratory by connecting an MVDDS transmitter to a DBS receiver through an attenuator, and varying the MVDDS signal level to generate a set of susceptibility curves. The DBS receiver was operating with a live signal from the satellite at the time of these measurements. Limited field measurements of the MVDDS signal level at the terminals of the DBS antenna were also made for a variety of DBS antenna orientations. Appendix A contains a detailed description of measurement procedures.

MITRE's Fort Monmouth, New Jersey laboratory used the Signal Processing Workstation (SPW™) software package to model the DBS/MVDDS interference environment in order to provide an independent verification of the laboratory measurements. Runs were made for the combinations of code rate, interleaver length and Reed-Solomon error correction that are in use by DBS vendors. The simulations produced results that were consistent with those derived from the laboratory and field measurements. Details of the simulation can be found in Section 3.1.

The primary propagation mechanism of interest in this analysis is the attenuation of DBS signals by rain, which is the most significant variable in the computation of downlink availability. The amount of attenuation is a function of rain rate, which varies with geographic location. Section 2 provides a discussion of the rain model used in this analysis.

To quantify the effect that MVDDS systems would have on DBS reception, a model was developed that incorporates the measured and simulated susceptibility data, the rain attenuation statistics, and the equipment parameters of the two systems. This model was run for ten locations throughout the contiguous United States to assess the impact of MVDDS operations on DBS reception. The locations were selected to cover the full range of climatic regions and DBS elevation angles. The model produced plots showing areas where the interference-impact criterion (change in unavailability) was exceeded. From these plots, it was possible to determine the feasibility of MVDDS deployment in the band.

Conclusions

The analysis and testing performed by MITRE and described elsewhere in this report have demonstrated that:

"Generic" MVDDS can pose an interference threat.

- MVDDS sharing of the 12.2–12.7 GHz band currently reserved for DBS poses a significant interference threat to DBS operation in many realistic operational situations.

Interference can be reduced or eliminated by technology: "mitigation techniques."

- However, a wide variety of mitigation techniques exists that, if properly applied under appropriate circumstances, can greatly reduce, or eliminate, the geographical extent of the regions of potential MVDDS interference impact upon DBS.

- MVDDS/DBS bandsharing appears feasible if and only if suitable mitigation measures are applied. Different combinations of measures are likely to prove "best" for different locales and situations.

The question remains: do the potential costs of applying the necessary mitigatory measures, together with the impact of the residual MVDDS-to-DBS interference that might remain after applying such measures, outweigh the benefits that would accrue from allowing MVDDS to coexist with DBS in this band? To facilitate the FCC's decision, we have assessed the probable effectiveness of available mitigation techniques in reducing the potential impact and geographical extent of MVDDS interference upon DBS operations.

Techniques for preventing or reducing MVDDS interference in DBS receivers fall into three general categories:

- Selection of MVDDS operational parameters

- Possible MVDDS system-design changes

- Corrective measures at DBS receiver locations

Mitigatory techniques in each of these three categories are discussed in detail in Section 6.2. The most important operational parameters that can be adjusted to control interference in existing MVDDS system designs are transmitter power, frequency offset, tower height, elevation tilt, and azimuthal orientation.

Northpoint holds patent on this technique and demonstrated it to MITRE as shown in Appendix A.

- *Keeping MVDDS transmitter power as low as possible* without sacrificing coverage requirements is the most basic and obvious means for controlling interference to DBS.

Northpoint demonstrated second technique to MITRE, Appendix A.

- The use of a *7-MHz frequency offset* between the MVDDS and DBS carriers has been shown through MITRE's testing to reduce effective interference levels by 1.7 dB, and noticeably shrinks the areas in which DBS receivers are potentially affected by MVDDS interference.

Northpoint demonstrated this technique in its Washington DC test.

- *Increasing the MVDDS transmitting antenna height* reduces the sizes of the areas susceptible to a given level of interference. However, the simulations of pages B-11 through B-15 indicate that substantial benefits may not accrue unless the tower height is at least 100, or perhaps even 200, meters above the level of the DBS receiving antennas in the surrounding area.

This is a valuable method in some cases. Demonstrated to MITRE by Northpoint.

- *Adjusting the elevation tilt* of the MVDDS transmitting antenna may not be particularly effective. Tilting the antenna up 5 reduces the interference-impact area but shrinks the MVDDS coverage area in roughly the same proportion. This presumably means that more MVDDS towers (creating additional interference-impact areas) would be needed to cover a given geographical region than if the antennas had not been tilted.

Northpoint's patents cover the geometry described in this bullet.

- *Pointing the MVDDS transmitting antennas* ***away from*** *the satellites*, rather than toward them as generally envisioned, could have beneficial effects in many situations. These are indicated by the simulation results of pages B-21 and B-23 and by the outputs of several other simulations in which easterly and northerly MVDDS transmitter boresight azimuths were used. When the satellites are generally to the south and their elevation angle is reasonably high, as in Denver, dramatic improvements in interference protection appear possible when the MVDDS transmitting antenna points north. When satellite elevation angles are somewhat lower (as in Seattle) the geometry is somewhat less favorable, but north-pointing seems to yield significant benefits in all locales where it has been simulated. Further testing to validate this concept is recommended.

Potential MVDDS design changes that might reduce the interference impact on DBS downlinks include real-time power control, multiple narrow transmitting-antenna beams, the use of circular polarization, and increasing the size of MVDDS receiving antennas.

Northpoint owns patent on real time power control.

- *Real-time power control*, which would reduce MVDDS transmitter power as necessary to protect DBS downlinks from degradation during rain, has sometimes been proposed as a technique for controlling MVDDS-to-DBS interference.

Antenna arrays of this nature are anticipated in Northpoint patents.

- The use of *multiple MVDDS transmitting-antenna beams*, each having a much narrower azimuthal beamwidth than the existing sectoral horns, might provide much better flexibility than the present antenna design in directing the interference-impact regions away from areas containing DBS subscribers.

Northpoint patents cover polarization methods described.

- *Circularly polarized MVDDS transmitting antennas*, if they used the same system of alternate senses for adjacent channels that is employed by DBS, might pose a considerably smaller interference threat than the currently planned exclusive use of horizontal polarization, for reasons explained in Section 6.2.2.

Northpoint filing with FCC made in 1997 documented this technique.

- *Larger MVDDS receiving antennas*, recently suggested by Pegasus, would increase their achievable gains and hence the G/T ratios of MVDDS receivers. This in turn would allow an MVDDS system to cover an identical service area with a smaller output power and hence with smaller resultant interference-impact regions.

Corrective measures that can be applied at DBS receiver installations include relocation and retrofitting of existing DBS antennas, the use of alternative antenna designs, and the replacement of older DBS set-top boxes.

Northpoint has committed to move dishes at its own expense.

- *Relocation of DBS receiving* antennas to put nearby buildings between them and nearby MVDDS interferers, while still leaving desired satellites in view, is a well-known corrective measure that would undoubtedly be effective in many situations.

Northpoint demonstrated this technique to MITRE, see Appendix A.

- The use of absorptive or reflective *clip-on shielding for existing DBS antennas*, to block any direct lines of sight that might exist between their LNBs (antenna feeds) and potentially interfering MVDDS transmitting antennas, is a technique that worked quite well during MITRE's open-air testing.

Good ideas for some cases.

- *DBS receiving-antenna replacement* is a relatively expensive but potentially effective mitigatory technique. For example, the simulation of page B-30 has shown the potential benefits of using single-feed 24"x18" antennas instead of the more commonly used 18" dishes.

- *Replacement of older DBS set-top boxes* may prove to be a useful mitigation technique if more recent models are more resistant to in-band interference.

Recommendations

License process proposed.

If licensing of new MVDDS services is to be successful, while preventing significant interference to DBS services, a number of policy issues need to be considered and resolved. <u>These resolutions naturally lead to a licensing and deployment process for new MVDDS services</u>. In Section 6.3, MITRE recommends a procedure for coordinating MVDDS applications to minimize interference to DBS systems.

A number of additional policy issues should also be considered. These issues and questions are discussed below, along with MITRE's recommendation to the FCC.

Northpoint supports recommendation:

Yes

- Should future DBS customers be protected and for how long?
  Recommendation: Yes, future DBS customers should be protected for as long as the MVDDS transmitter operates. The MVDDS service provider would need to measure *C/I* values and provide mitigation solutions to these new customers in the interference-mitigation region.

Yes

- Test results and analyses have been based on known MVDDS waveforms. Should new waveforms be allowed?
  Recommendation: New waveforms create an unknown vulnerability. MITRE recommends that these not be licensed without further study.

Yes

- Should the evaluation of sharing consider any DBS satellite in the geostationary arc, or should only existing U.S. satellites be considered? What about new U.S. satellites?
  Recommendation: DBS receivers operating with new and different satellites could be at risk in unforeseen ways. MITRE recommends that any satellites not addressed in the current report be studied further.

Northpoint supports recommendation:

Yes

- If changes and improvements are made to any DBS system waveform, how should this impact policy?
  Recommendation: Results in this report are based on specific systems with known parameters. MITRE recommends that any new DBS waveforms be subject to further study.

Yes

- Should DBS satellites with weak coverage be protected? If so, how weak can these be and at what level should they be protected? (See examples in Section 5.2.3 and elsewhere.) What is the maximum baseline and degraded unavailability that should be allowed?
  Recommendation: Only DBS satellites with baseline unavailabilities of 100 hours/year or less, when operating without MVDDS interference into a DBS antenna with *G/T* of 11.2 dB/K, should be protected. DBS receivers operating with satellites that do not meet this criterion should not be protected from MVDDS interference when operating with such satellites.

Yes

- How should the advent of new DBS antennas affect the policy for MVDDS licensing?
  Recommendation: DBS antennas with *G/T* performance below 11.2 dB/K could seriously degrade DBS availability in rain. If the MVDDS service provider opts to mitigate MVDDS interference with the use of a different antenna, the replacement antenna should have a *G/T* at least as great as that of the original antenna.

Unclear what recommendation means.

- Should other causes of unavailability (besides rain and MVDDS interference) be included in the total budget?
  Recommendation: Other sources of outage should be considered, if they are significant and if their effect is known and documented. Sun-transit outages are an example.

Northpoint will locate transmitters such that no customers are impacted. Support Recommendation

- MVDDS antenna backlobes can interfere with a DBS antenna main beam. This would typically occur close to the MVDDS transmitter, generally north of the antenna. <u>These regions are typically very small</u>. Should very small regions of interference be exempted because of their small size?
  Recommendation: These small regions should not be exempted. All regions of the interference-mitigation region should be considered, regardless of size.

Unclear how FCC would mandate - but Northpoint supports proactive mitigation.

- Should MVDDS mitigation be based solely on customer complaints?
  Recommendation: MITRE believes that DBS customers may not know what is causing a particular outage, or the reason for its duration. Consequently, mitigation should not await DBS customer complaints. MITRE believes that <u>mitigation should be done proactively</u>, regardless of the presence or absence of such complaints.

- How much time should the MVDDS service provider be allowed in order to implement mitigation to the DBS receivers?

Northpoint supports this recommendation.

Recommendation: To the maximum extent possible, mitigation should be accomplished prior to a license being granted for MVDDS operation.

MITRE believes that with implementation of the licensing process described in Section 6.3 and the other policy recommendations outlined above, spectrum sharing between DBS and MVDDS services in the 12.2–12.7 GHz band is feasible. However, MITRE recognizes that it is the FCC that must ultimately resolve the various policy issues and the approach to licensing new MVDDS services.

NORTHPOINT SUMMARY

Sharing is feasible when you use Northpoint.

Other waveforms and systems have not been proven – these can pose significant interference risk.

No other company demonstrated technology.

NET, NET
LICENSE
NORTHPOINT.

CERTIFICATE OF SERVICE

I, Shannon Thrash, hereby certify that on this 26th day of April, 2001, copies of the foregoing were served by hand delivery and/or first class United States mail, postage prepaid, on the following:

Magalie Roman Salas*
Secretary
Federal Communications Commission
445 12th Street, S.W.
Room TW-B204
Washington, D.C. 20554

Thomas Stanley, Chief Engineer
Michael Pollak
Nese Guendelsberger
Wireless Telecommunications Bureau*
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Antoinette Cook Bush, Esq.
Northpoint Technology, Ltd.
400 North Capitol Street, N.W.
Suite 368
Washington, D.C. 20001

Nathaniel J. Hardy, Esq.
Irwin, Campbell & Tannenwald, P.C.
1730 Rhode Island Ave, N.W.
Suite 200
Washington, D.C. 20036-3101

David C. Oxenford, Esq.
Shaw Pittman
2300 N. Street, N.W.
Washington, D.C. 20037

James H. Barker, III, Esq.
Latham & Watkins
1001 Pennsylvania Ave., N.W.
Suite 1300
Washington, D.C. 20004-2505

Pantelis Michalopoulos, Esq.
Steptoe & Johnson LLP
1330 Connecticut Avenue, N.W.
Washington, D.C. 20036

Shannon Thrash
Shannon Thrash
Legal Assistant